VDM Vascular Disease Management

CASE SERIES

Techniques of Mesenteric Artery Recanalization for Chronic Mesenteric Ischemia

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Abstract

Chronic mesenteric ischemia (CMI) is rare and often underdiagnosed or presents late, classically with postprandial angina and malnutrition. Good quality cross-sectional imaging is required to diagnose and plan treatment. CMI can be caused by stenosis, occlusion, or dissection of one or more mesenteric arteries. The endovascular-first approach has good technical success with less morbidity and mortality. Here we discuss different technical details to improve technical success.

Introduction

Chronic mesenteric ischemia (CMI) is characterized by postprandial angina. CMI occurs due to reduced blood supply to the intestines as a result of critical stenosis or occlusion of 1 or more of the 3 mesenteric arteries: the celiac artery (CA), the superior mesenteric artery (SMA), and the inferior mesenteric artery (IMA). Without treatment, symptomatic CMI can cause severe malnutrition or acute intestinal ischemia.

The proximal location and focal nature of mesenteric arterial lesions make them amenable to endovascular treatment. Technical advances in terms of cross-sectional imaging and low-profile hardware have greatly improved the technical success of endovascular mesenteric revascularization.

Here, we describe the technical nuances of successful revascularization in CMI caused by stenosis, occlusion, or dissection of the SMA.

Case series

In this case series we discuss technical details in terms of route of access, support hardware, and choice of wire and stent for SMA stenosis, occlusion, and dissection.

Case 1

A middle-aged smoker presented with severe postprandial angina. Contrast-enhanced computed tomography (CT) of the abdomen showed occlusion of the CA and IMA with high-grade focal stenosis of the SMA (**Figure 1A**). Via left brachial artery access, coaxial assembly of a 6F 90 cm sheath and

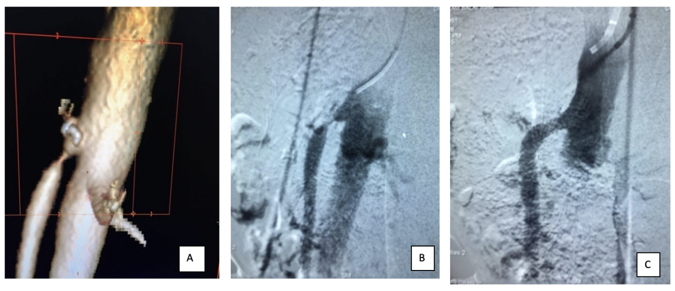

Figure 1. (A) Computed tomography volume-rendered image shows critical stenosis of the proximal superior mesenteric artery. **(B)** Digital subtraction angiography confirms the focal proximal stenosis. **(C)** After angioplasty and stenting, angiography shows no residual stenosis.

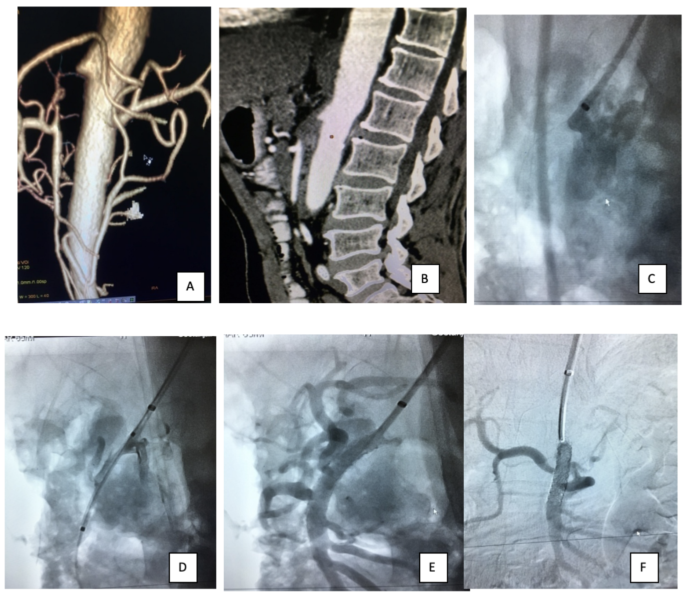

Figure 2. (A, B, C) Volume-rendered image, minimum intensity projection, and digital subtraction angiography image shows proximal superior mesenteric artery occlusion with a small ostial remnant. **(D)** The lesion was crossed with a 0.035" wire. **(E, F)** Post stenting angiography depicting good apposition and position of the stent.

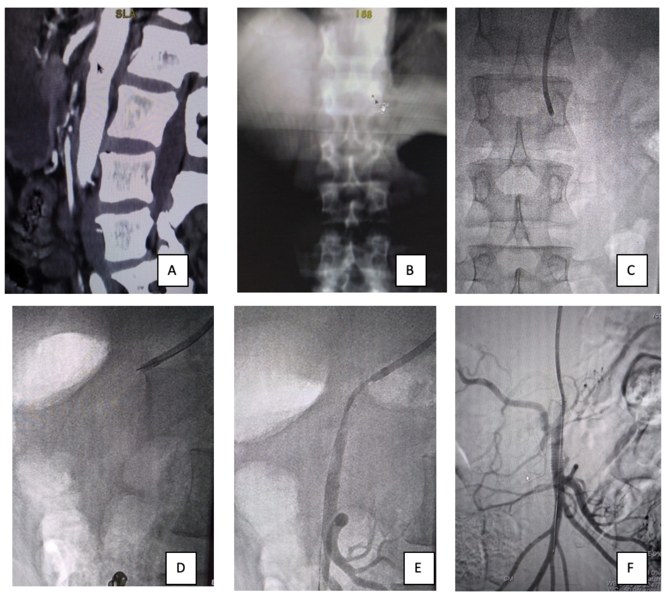

Figure 3. (A) Minimum-intensity projection image shows a small ostial remnant with an irregular aorta. **(B)** Ostium marked on ray-summation (raysum) image for localization of the ostium on fluoroscopy. **(C, D)** Fluoroscopy image in anteroposterior and lateral projection depicting the position and direction of the guide catheter using raysum image extrapolation. **(E)** Angiography after angioplasty shows residual stenosis with recoil. **(F)** The final angiogram after stent deployment showed no residual stenosis.

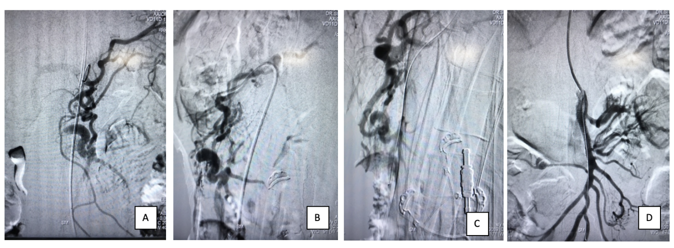

Figure 4. (A, B) Anteroposterior and lateral projection of celiac artery digital subtraction angiography images using a Sim 1 catheter from a femoral approach show distal reformation of the superior mesenteric artery. **(C)** The wire is seen in the true lumen crossed under double injection. **(D)** Post-stenting angiogram shows good apposition of the stent.

Judkins right coronary guide was taken in the suprarenal aorta. The lesion was crossed using a 0.014" Sion black (Asahi Intec) guidewire predilated with a 5 mm monorail coronary balloon and stented with 6 mm x 20 mm bare metal Hippocampus renal RX stent (Medtronic) (**Figures 1B** and **1C**).

Case 2

A middle-aged man presented with classical postprandial pain and weight loss. CT of the abdomen showed chronic total occlusion (CTO) of the SMA with occlusion of the CA and stenosis of the IMA (**Figures 2A, 2B,** and **2C**). Via the left brachial artery, coaxial assembly of a 6F long sheath and 5F multipurpose catheter was taken in the suprarenal aorta. The lesion was crossed with a 0.035" straight-tip hydrophilic Glidewire (Terumo), predilated with a 6 mm angioplasty balloon and stented with 7mm x 27 mm VIsi-Pro balloon-expandable stent (Medtronic) (**Figures 2D, 2E,** and **2F**).

Case 3

An elderly man presented with typical features of CMI. CT of the abdomen showed occlusion of all 3 mesenteric arteries. There was long segment occlusion of the SMA with a small tear at the ostium along with atherosclerosis in the aorta (**Figure 3A)**. This made identification of ostial remnant difficult on angiography. We did post-processing of the CT angiogram images to locate the position of the ostial remnant on a ray-summation (raysum) image (**Figure 3B**). This helped in hooking the ostium with the EBU guide catheter (Medtronic) (**Figures 3C** and **3D**). The lesion was crossed with a 0.014" Miracle 6 guidewire (Asahi Intec). The lesion was predilated with a 4.5 mm rapid exchange balloon and stented with a 6 mm x 36 mm stent (**Figures 3E** and **3F**).

Case 4

The patient complained of pain after a meal. CT showed long segment occlusion of the SMA extending beyond gastroduodenal artery anastomoses. From brachial access, the SMA ostium was hooked. To map the distal vessel, another access was taken from the common femoral artery and using a Sim 1 catheter, celiac artery control injections were taken to identify the crossing of wire into the true lumen (**Figures 4A** and **4B**). The lesion was crossed with 0.14" CTO guidewire and stented with a 4.5 mm x 48 mm drug-eluting stent, which was post-dilated to 5.5 mm (**Figures 4C** and **4D**).

Case 5

In this case, a man who was previously treated by an endovascular approach using a bare metal stent presented with a recurrence of symptoms after 14 months. CT showed in-stent reocclusion. He was treated by a drug-eluting stent within the previous stent. After 8 months, he had a recurrence of symptoms and was taken for repeat intervention. Through right brachial access using a 6F long sheath and Judkins right coronary catheter, the stent was hooked (**Figure 5A**) and the lesion was crossed with a .035" hydrophilic guidewire (**Figure 5B**). The lesion was predilated with a 6 mm angioplasty balloon followed by a 6 mm x 80 mm paclitaxel-coated drug-eluting balloon (**Figures 5C** and **5D**).

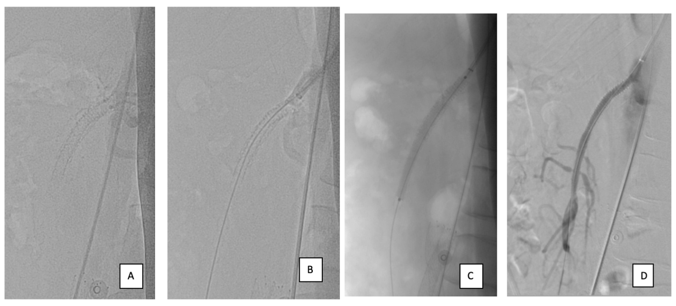

Figure 5. (A) Lateral projection shows in-stent reocclusion. **(B)** With support from the Judkins right catheter, the lesion is crossed with a 0.035" hydrophilic guidewire. **(C)** Paclitaxel-impregnated drug-eluting balloon inflated across the occluded segment. **(D)** Postangioplasty angiogram shows no residual stenosis.

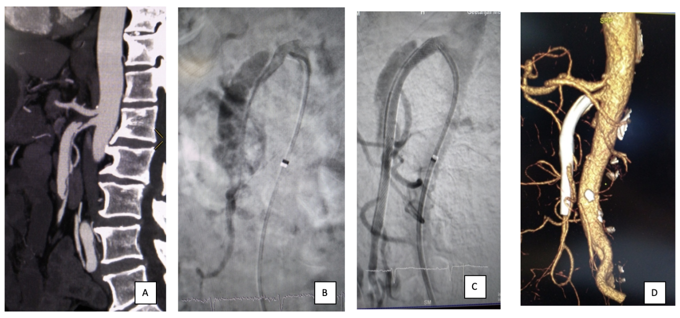

Figure 6. (A) Minimum-intensity projection image shows long segment dissection of the superior mesenteric artery with severe narrowing of the true lumen. **(B)** Selective angiogram shows dissection with the filling of the false lumen from the intimal tear. **(C)** Immediate post-procedure angiogram after reconstruction of the superior mesenteric artery using two 9 mm carotid wall stents with the filling of the false lumen. **(D)** Follow-up computed tomography after 6 months shows healing of dissection.

Case 6

An elderly man who was previously treated for coronary artery disease presented with CMI. He was taking double antiplatelets. CT abdomen showed a long segment dissection of the SMA with severe narrowing of the true lumen (**Figure 6A**). The SMA was dilated and measured 9 mm in diameter. Common femoral artery access with a 6F Balkin sheath was taken. Using a Judkins right guide catheter, the ostium was hooked and the lesion was gently crossed using a .014" wire (**Figure 6B**). The entire dissected segment was reconstructed using 2 carotid wall stents (**Figure 6C**). At a 6-month follow-up, CT showed complete healing of the dissection with obliteration of the false lumen (**Figure 6D**).

Discussion

Endovascular treatment as a first approach for patients with CMI is a safe strategy, with technical and clinical success rates comparable to open revascularization.[1] Technical success in our limited series was 100%. Another study published by Fioole et al showed a 93% success rate.[2] Technical success can be improved by using a tailored approach. A high index of clinical suspicion is required to diagnose these patients.

Typical symptoms of CMI include postprandial abdominal pain along with notable weight loss, sitophobia, nausea, vomiting, or diarrhea. The abdominal pain typically starts 15 to 30 minutes after eating and lasts for 30 minutes.[3]

On suspicion, cross-sectional imaging (preferably CT of the abdomen with contrast) should be performed to look for stenosis or occlusion of the mesenteric arteries. Reformatted images of CT help plan the access (radial, brachial, or femoral) as well as the hardware required for recanalization.

In a stenotic lesion, either the brachial or femoral approach is suitable; however, in the case of CTO, we prefer the brachial approach due to better pushability. The longer distance, compared with the femoral route, is counterbalanced by the more direct path. Furthermore, only 2 curves are encountered compared with 3 curves when using the femoral route.[4] A long sheath, usually 6F, is desirable in either route.

The choice of catheter from the femoral route is mostly a reverse curve catheter such as Sim 1. The choice of catheter from the brachial route is multipurpose, Judkins right coronary, or EBU. EBU is preferred when extra support is required, especially in the case of CTO.

The choice of wire between 0.035" and 0.014" is decided by several factors. Earlier, we used 0.035" wires as balloon and stent were compatible, especially with large diameters such as 6 mm, and 7mm with long length. With more experience, we have slowly moved on to 0.014" CTO wires. This allows smaller profile, rapid-exchange hardware to be used.

We believe in stenting of all lesions except in cases of in-stent restenosis or occlusion. The choice of stents largely depends on the size of the vessel. The first choice is a balloon-expandable stent.

In a vessel diameter up to 5.5 mm, we often use a drug-eluting coronary stent. Patients with vessel sizes larger than 5.5 mm are treated by bare metal stent, preferably 0.014" compatible and, rarely, 0.035" compatible in case of nonavailability. We have used a self-expandable carotid wall stent in a case of dissection. Having a 0.014" compatibility and low profile made this an easy choice. The wall stent was used because of the 9 mm size vessel and helped gradual obliteration of the false lumen and endothelization.

Patients who are treated with endovascular stenting sometimes return with a recurrence of symptoms due to in-stent reocclusion. We prefer to treat these patients by repeat angioplasty using drug-eluting balloons.

According to the hypothesis by Landis et al, stenting of the mesenteric arteries provides a better scaffold to the arterial wall against elastic recoil as opposed to angioplasty alone. This gives superior long-term patency and lower rates of reintervention.[5]

In our series, we decided to treat only SMA, and the patients had good symptomatic relief. Few series have already reported that SMA should be revascularized first and the CA can be treated later if the first procedure fails to give symptomatic relief.[4] Successful revascularization of 1 artery alone may provide good clinical improvement,[6] but the treatment of 2 arteries together increases the blood supply to the intestine and prevents symptom recurrence if 1 of the arteries gets narrowed or occluded again.[7]

Conclusion

CMI is rare, and symptoms appear late due to the presence of extensive collateralization. A high index of suspicion and good quality cross-sectional imaging can help with accurate diagnosis and treatment planning. The endovascular-first approach works well for patients with CMI. Technical success and feasibility have greatly increased with a wide variety of available hardware. ■

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